

**Part 1:**

1.

```
prob(X_tumor-size=45-49|y=recurrence-events)=0.01282051282051282  
prob(X_irradiat=yes|y=recurrence-events)=0.38461538461538464  
prob(X_tumor-size=15-19|y=recurrence-events)=0.07692307692307693  
prob(X_breast-quad=left_low|y=recurrence-events)=0.3974358974358974  
prob(X_inv-nodes=9-11|y=no-recurrence-events)=0.010582010582010581  
prob(X_irradiat=no|y=recurrence-events)=0.6153846153846154  
prob(X_inv-nodes=0-2|y=no-recurrence-events)=0.8465608465608465  
prob(X_deg-malig=1|y=no-recurrence-events)=0.291005291005291  
prob(X_tumor-size=40-44|y=recurrence-events)=0.07692307692307693  
prob(X_age=50-59|y=recurrence-events)=0.2692307692307692  
prob(X_tumor-size=10-14|y=recurrence-events)=0.01282051282051282  
prob(X_inv-nodes=6-8|y=recurrence-events)=0.1282051282051282  
prob(X_inv-nodes=9-11|y=recurrence-events)=0.0641025641025641  
prob(X_tumor-size=5-9|y=no-recurrence-events)=0.021164021164021163  
prob(X_menopause=promo|y=no-recurrence-events)=0.5132275132275133  
prob(X_breast-quad=right_low|y=no-recurrence-events)=0.08994708994708994  
prob(X_tumor-size=10-14|y=no-recurrence-events)=0.13227513227513227  
prob(X_tumor-size=25-29|y=recurrence-events)=0.23076923076923078  
prob(X_breast-quad=left_up|y=recurrence-events)=0.3076923076923077  
prob(X_age=40-49|y=no-recurrence-events)=0.32275132275132273  
prob(X_deg-malig=2|y=recurrence-events)=0.358974358974359  
prob(X_breast-quad=central|y=no-recurrence-events)=0.08465608465608465  
prob(X_menopause=promo|y=recurrence-events)=0.6153846153846154  
prob(X_tumor-size=30-34|y=no-recurrence-events)=0.1746031746031746  
prob(X_breast-quad=right_low|y=recurrence-events)=0.07692307692307693  
prob(X_irradiat=no|y=no-recurrence-events)=0.8465608465608465  
prob(X_inv-nodes=0-2|y=recurrence-events)=0.5384615384615384  
prob(X_inv-nodes=3-5|y=recurrence-events)=0.19230769230769232  
prob(X_tumor-size=50-54|y=recurrence-events)=0.038461538461538464  
prob(X_inv-nodes=6-8|y=no-recurrence-events)=0.037037037037037035  
prob(X_age=20-29|y=no-recurrence-events)=0.005291005291005291  
prob(X_age=60-69|y=recurrence-events)=0.20512820512820512  
prob(X_tumor-size=15-19|y=no-recurrence-events)=0.1164021164021164  
prob(X_age=40-49|y=recurrence-events)=0.3333333333333333  
prob(X_deg-malig=3|y=recurrence-events)=0.5384615384615384  
prob(X_deg-malig=2|y=no-recurrence-events)=0.5132275132275133  
prob(X_tumor-size=50-54|y=no-recurrence-events)=0.021164021164021163  
prob(X_age=70-79|y=no-recurrence-events)=0.026455026455026454  
prob(X_tumor-size=40-44|y=no-recurrence-events)=0.08465608465608465  
prob(X_tumor-size=35-39|y=recurrence-events)=0.08974358974358974  
prob(X_menopause=ge40|y=no-recurrence-events)=0.4603174603174603  
prob(X_tumor-size=35-39|y=no-recurrence-events)=0.0582010582010582
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prob(X\_inv-nodes=15-17|y=no-recurrence-events)=0.015873015873015872  
prob(X\_breast=right|y=recurrence-events)=0.44871794871794873  
prob(X\_breast=right|y=no-recurrence-events)=0.49206349206349204  
prob(X\_age=60-69|y=no-recurrence-events)=0.19576719576719576  
prob(X\_irradiat=yes|y=no-recurrence-events)=0.15343915343915343  
prob(X\_breast-quad=left\_low|y=no-recurrence-events)=0.37037037037037035  
prob(X\_tumor-size=25-29|y=no-recurrence-events)=0.164021164021164  
prob(X\_breast-quad=right\_up|y=no-recurrence-events)=0.10582010582010581  
prob(X\_breast=left|y=no-recurrence-events)=0.5079365079365079  
prob(X\_age=50-59|y=no-recurrence-events)=0.3386243386243386  
prob(X\_tumor-size=20-24|y=no-recurrence-events)=0.17989417989417988  
prob(X\_tumor-size=45-49|y=no-recurrence-events)=0.010582010582010581  
prob(X\_tumor-size=0-4|y=no-recurrence-events)=0.037037037037037035  
prob(X\_breast=left|y=recurrence-events)=0.5512820512820513  
prob(X\_menopause=ge40|y=recurrence-events)=0.38461538461538464  
prob(X\_inv-nodes=15-17|y=recurrence-events)=0.038461538461538464  
prob(X\_inv-nodes=12-14|y=recurrence-events)=0.02564102564102564  
prob(X\_menopause=lt40|y=no-recurrence-events)=0.026455026455026454  
prob(X\_node-caps=no|y=no-recurrence-events)=0.8783068783068783  
prob(X\_tumor-size=30-34|y=recurrence-events)=0.28205128205128205  
prob(X\_age=30-39|y=no-recurrence-events)=0.1111111111111111  
prob(X\_node-caps=yes|y=no-recurrence-events)=0.12169312169312169  
prob(X\_node-caps=yes|y=recurrence-events)=0.3974358974358974  
prob(X\_deg-malig=3|y=no-recurrence-events)=0.19576719576719576  
prob(X\_deg-malig=1|y=recurrence-events)=0.10256410256410256  
prob(X\_inv-nodes=12-14|y=no-recurrence-events)=0.005291005291005291  
prob(X\_tumor-size=20-24|y=recurrence-events)=0.166666666666666666  
prob(X\_breast-quad=left\_up|y=no-recurrence-events)=0.3492063492063492  
prob(X\_inv-nodes=3-5|y=no-recurrence-events)=0.08465608465608465  
prob(X\_tumor-size=0-4|y=recurrence-events)=0.01282051282051282  
prob(X\_node-caps=no|y=recurrence-events)=0.6025641025641025  
prob(X\_breast-quad=central|y=recurrence-events)=0.05128205128205128  
prob(X\_breast-quad=right\_up|y=recurrence-events)=0.166666666666666666  
prob(X\_inv-nodes=24-26|y=recurrence-events)=0.01282051282051282  
prob(X\_age=30-39|y=recurrence-events)=0.19230769230769232

## 2.

prob(y=recurrence-events)=0.29213483146067415  
prob(y=no-recurrence-events)=0.7078651685393258

**3.**

For Instance X with values: 50-59 premeno 50-54 0-2 yes 2 right left\_up yes

Predicted class: recurrence-events, Actual class: no-recurrence-events

Score for test instance when class = no-recurrence-events is: 3.629530412287136E-6

Score for test instance when class = recurrence-events is: 7.594221504873088E-6

For Instance X with values: 50-59 ge40 35-39 0-2 no 2 left left\_up no

Predicted class: no-recurrence-events, Actual class: no-recurrence-events

Score for test instance when class = no-recurrence-events is: 3.6797742262389835E-4

Score for test instance when class = recurrence-events is: 3.300628314268497E-5

For Instance X with values: 50-59 premeno 10-14 3-5 no 1 right left\_up no

Predicted class: no-recurrence-events, Actual class: no-recurrence-events

Score for test instance when class = no-recurrence-events is: 5.121812186306055E-5

Score for test instance when class = recurrence-events is: 6.266024327040336E-7

For Instance X with values: 40-49 premeno 10-14 0-2 no 2 left left\_low yes

Predicted class: no-recurrence-events, Actual class: no-recurrence-events

Score for test instance when class = no-recurrence-events is: 1.7084526985564145E-4

Score for test instance when class = recurrence-events is: 7.54055108078347E-6

For Instance X with values: 50-59 ge40 15-19 0-2 yes 2 left central yes

Predicted class: no-recurrence-events, Actual class: no-recurrence-events

Score for test instance when class = no-recurrence-events is: 4.480484499637462E-6

Score for test instance when class = recurrence-events is: 1.9437590756520403E-6

For Instance X with values: 50-59 premeno 25-29 0-2 no 1 left left\_low no

Predicted class: no-recurrence-events, Actual class: no-recurrence-events

Score for test instance when class = no-recurrence-events is: 6.953248058985191E-4

Score for test instance when class = recurrence-events is: 5.01156625676686E-5

For Instance X with values: 60-69 ge40 25-29 0-2 no 3 right left\_low no

Predicted class: no-recurrence-events, Actual class: no-recurrence-events

Score for test instance when class = no-recurrence-events is: 2.3496747059008078E-4

Score for test instance when class = recurrence-events is: 1.0197954592258144E-4

For Instance X with values: 60-69 ge40 20-24 0-2 no 1 right left\_up no

Predicted class: no-recurrence-events, Actual class: recurrence-events

Score for test instance when class = no-recurrence-events is: 3.611867632361164E-4

Score for test instance when class = recurrence-events is: 1.0861108833536582E-5

For Instance X with values: 40-49 ge40 30-34 3-5 no 3 left left\_low no

Predicted class: recurrence-events, Actual class: recurrence-events

Score for test instance when class = no-recurrence-events is: 4.25673273491314E-5

Score for test instance when class = recurrence-events is: 8.887078059494804E-5

For Instance X with values: 50-59 ge40 30-34 3-5 no 3 left left\_low no

Predicted class: recurrence-events, Actual class: recurrence-events

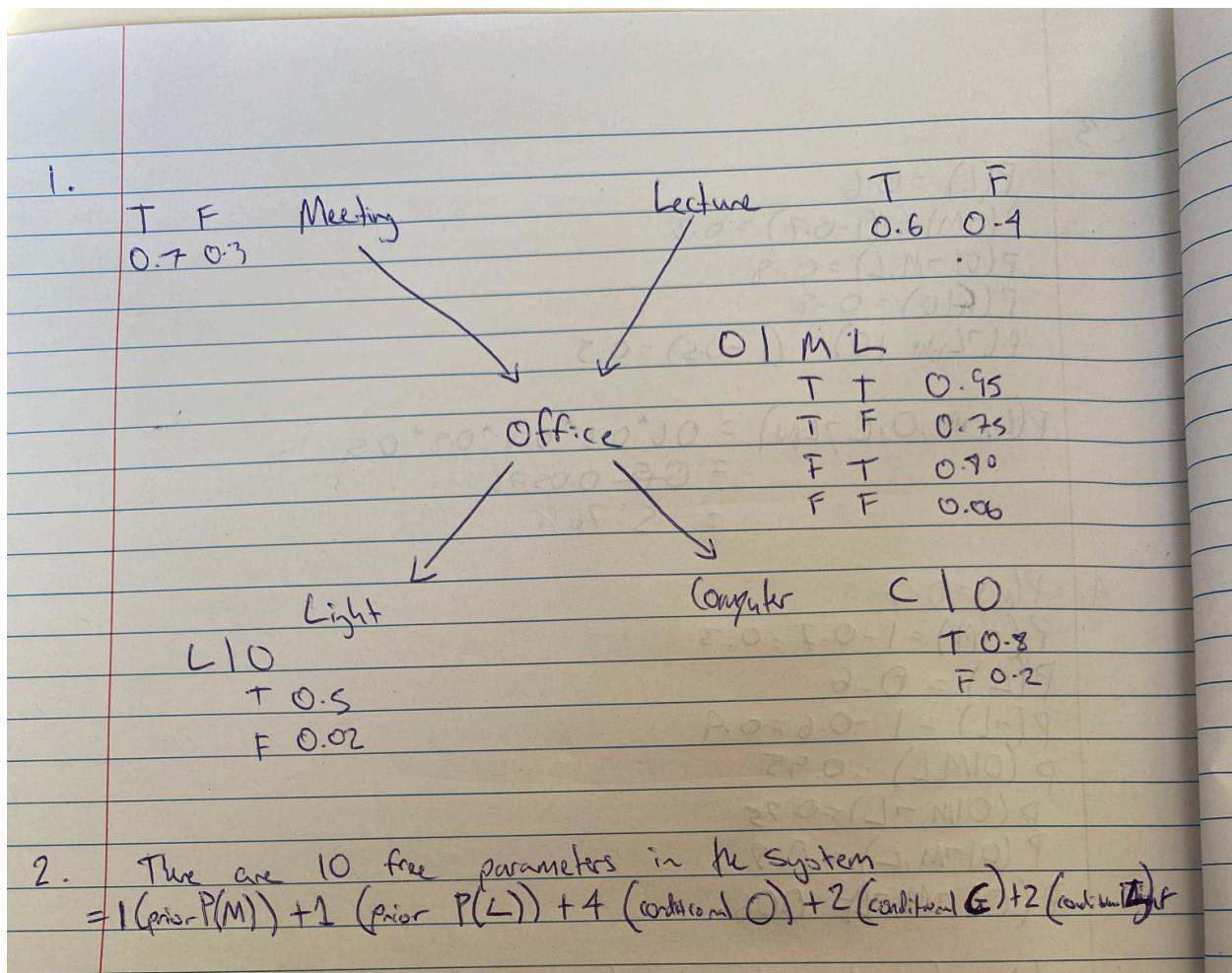
Score for test instance when class = no-recurrence-events is: 4.4660802464662444E-5

Score for test instance when class = recurrence-events is: 7.178024586515035E-5

**Accuracy:** 80%

**Part 2:**

1.2



3-5

3.

$$P(L) = 0.6$$

$$P(\neg M) = (1 - 0.7) = 0.3$$

$$P(OI \rightarrow M, L) = 0.8$$

$$P(\neg OI) = 0.2$$

$$P(\neg L | OI) = (1 - 0.5) = 0.5$$

$$\begin{aligned} P(L, \neg M, OI, \neg L | OI) &= 0.6 * 0.3 * 0.8 * 0.5 \\ &= 0.0576 \\ &= 5.76\% \end{aligned}$$

4.  $P(M) = 0.7$

$$P(\neg M) = 1 - 0.7 = 0.3$$

$$P(L) = 0.6$$

$$P(\neg L) = 1 - 0.6 = 0.4$$

$$P(OI | M, L) = 0.95$$

$$P(OI | M, \neg L) = 0.75$$

$$P(OI \neg M, L) = 0.9$$

$$P(OI \neg M, \neg L) = 0.06$$

$$\begin{aligned} P(O) &= (0.95 * 0.7 * 0.6) + (0.75 * 0.7 * 0.4) + (0.9 * 0.3 * 0.6) + \\ &(0.06 * 0.3 * 0.4) = 0.399 + 0.21 + 0.144 + 0.0072 \\ &= 0.7602 \\ &= 76.02\% \end{aligned}$$

5.  $P(C | O) = 0.8$

$$P(\neg L | O) = 1 - 0.5 = 0.5$$

$$P(C, \neg L | O) = 0.8 * (1 - 0.5)$$

$$= 0.4$$

$$70\%$$